KN2C Small Size Team Description Paper

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Team Members

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Abstract

This is a paper about *KN2C Small Size Soccer Team* which is divided to four parts. These parts are mechanics, electronics, image processing and other software.

1 Introduction

KN2C team has started its ac vi es since November of 2009. But researches about this field returns to the time when most of team members were in Allame Helli high school and some of them were working on small size soccer and junior soccer leagues in 2007. Back then team members had some achievements which I can mention to compe ng in SSL of Iran Open 2008 (I consider this as an achievement because we were high school students), second and third places of junior soccer in Iran Open compe ons of 2007 and 2008, and second place of junior soccer in Kharazmi na onal compe ons in 2008.

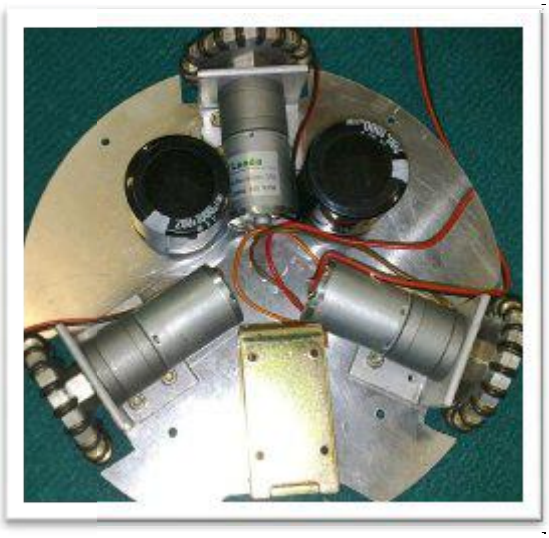
After team members became to K.N.Toosi University, they arranged their new team under supervision of Dr. Mehdi Aliyari – a member of mechatronic group – and they are looking for a very glorious future.

Picture 1: an archetype of KN2C robots

Picture 2: KN2C robots

2 Mechanics

Robots are made of three surfaces. First one consists of motors, solenoid, capacitors of kicking board and batteries. It is considered to locate different parts of this surface in the right place. Because we wanted to set center of mass in order to be in the center of the surface. It makes torque equal to zero.



Picture 3: First surface

Second surface consists of electrical boards. And third surface is available for image processing's markers.

Picture 4: Second surface

2.1 Dynamic System

Speed of motors with gear boxes is 600 RPM. Power supply of motors is 12 V and gear boxes are 13.6/1. Angle between each pair of motors is 120˚ because this type of placing motors allows robots to move in all directions of X-Y surface and turn in direction of Z Axis. Because of this wheels are omni directional.

Picture 5: Omni Directional wheel

3 Electronics

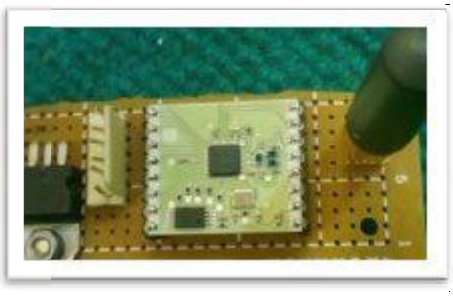
3.1 Microcontroller

Microcontroller, which is used to process data in robots, is ATmega-16 (belonged to AVR family). Procedure is this, data arrives from wireless module. Then microcontroller get's this data with USART protocol. Finally microcontroller send's orders to mechanical parts. Some other duties like reading voltage of batteries and operating kicking board is devolved to microcontroller.

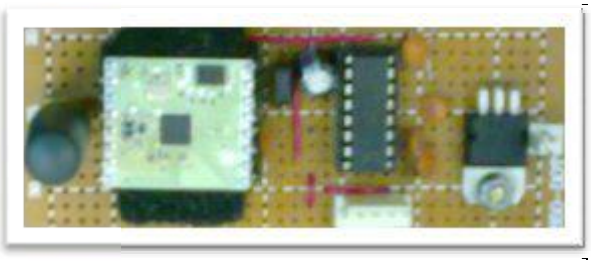
3.2 Wireless communica o

MULTICHANNEL RADIO TRANSCEIVER RXQ2-XXX GFSK modules are used to connect computer to robots via radio waves. These modules are

available in frequencies of 433Hz and 868Hz. So it can be changed in competitions which our opponent has same frequency.



Picture 6: reciever



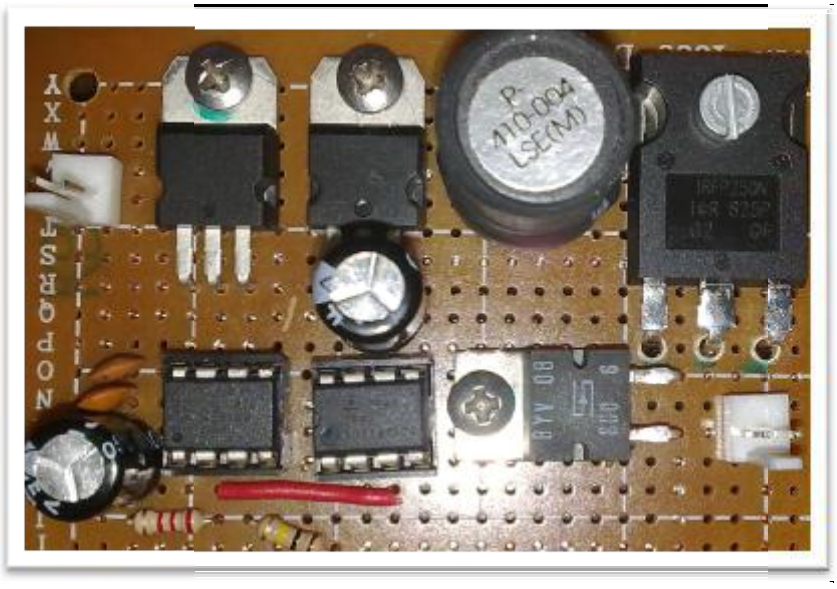
Picture 7: transmitter

3.3 Motor's deriver

Each motor is operated with a full H-bridge driver named *L6203*. And speed of motors can be controlled with PWM pulse of microcontroller. (Due to connec ng enable pin of L6203 tc microcontroller)

3.4 Kicking

Each robot has a direct kicking system and a boost convertor circuit is used for kicking. With connecting and disconnecting voltage across the inductor, voltage increases. (It's possible because of electrical property of inductors). In this case 12V is converted to 150V. And it is stored in capacitors. Two 1100µF capacitors are used in each robot. In time of kicking energy of capacitors will be vacated in solenoid and it will kick ball directly.



Picture 8: Boost Convertor circuit

4 Image processing

4.1 Hardware

4.1.1 Cameras

Hardware which is needed to run the process is 1394 cameras. In this case we use two *s ngray_046C*cameras. The most important property of this camera is its high speed (61fps). This property makes it efficient for image processing. Technical features of camera are written in this table:

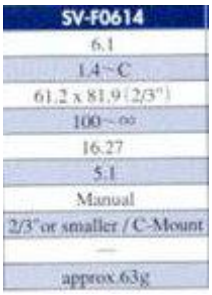
	Stingray F-046 B/C
Image device	Type 1/2 (diag. 8 mm), progressive scan CCD, SONY ICX 415
Picture size	780 (H) x 580 (V)
Cell size	8.3 µm x 8.3 µm
Resolution depth	8 bit / 14 bit (16 bit in High SNR mode)
Lens mount	C-Mount / CS-Mount
Digital interface	IEEE1394b, (IIDC V1.31) S 800 daisy chain
Transfer rate	100 Mbit/s, 200 Mbit/s, 400 Mbit/s, 800 Mbit/s
Frame rates	Up to 61 fps (full resolution)
Gain control	Manual: 0...24 dB, auto gain
Shutter speed	30 µs ... ~ 67 s, auto shutter
Image pre-processing	LUT; shading correction; High SNR mode; white balance; color interpolation (debayering); local color anti aliasing; hue; saturation; sub-sampling; 2x - 8x binning (only b/w) or sub-sampling; separate reference AOI for auto features
Grabber features	32 MB on-board memory; deferred image transport; trigger delay; multi-shot; mirror image; several trigger modes; SIS (secure image signature); sequence mode; storable user sets
Power requirements	DC 8 V - 36 V; < 3.5 W @ 12 V
Dimensions	72.8 mm x 44 mm x 29 mm (L x W x H)
Mass	92 g (without lens)
Operating temperature	+ 5 ... + 45° Celsius
Regulations	CE, FCC Class B, RoHS (2002/95/EC)

Table 1: Technical features of S ngray_046C

Picture 9: S ngray_046C

4.1.2 Lens

Model of lenses is *SV-F614*. Focal length of this model is 6.1 mm. Efficient focal length ,which is calculated for SSL field, is 4.8mm. But a lens with this focal length wasn't available and we used an Upper one. Technical features of this lens are written in this table:



SV-F0614
6.1
1.4~C
61.2 x 81.9 (2/3")
100~∞
16.27
5:1
Manual
2/3" or smaller / C-Mount
—
approx.63g

Table 2: Technical features of SV-F614

4.2 So ware

Software is divided to three parts. These parts are SSL-vision, planning and microcontroller's program.

4.2.1 SSL-Vision

SSL-Vision is an open source program which is written for image processing. Due to rules declared by SSL organizing committee, using this program is mandatory for all of teams since 2010. So we decided to use this program for par cipa ng in robocup 2010.

This program run's in Ubuntu 8.4 and a er receiving video fom cameras and processing it; SSL-Vision determines angles and coordinates of robots and coordinates of ball. Then this data is sent to another computer.

4.2.2 Planning

After receiving data from SSL-Vision and processing them in second computer, tactics of game will be planed. Then orders will be sent to robots via wireless module. From abilities of this part I can mention to finding efficient robot for offense, finding direction of robot's movement, kicking and locating robots. Programs of this part are written by *QT4*.

4.2.3 Microcontroller's program

Program's for robots which are programmed in microcontroller are written by *Code Vision AVR*. This program is concordant with C language.